

## Construction Specification 495 – Geotextile

### 1. Scope

This work consists of furnishing all material, equipment, and labor necessary for the installation of geotextiles.

### 2. Quality

Fibers (threads and yarns) used in the manufacture of geotextile shall consist of synthetic polymers composed of a minimum of 85 percent by weight polypropylenes, polyesters, polyamides, polyethylene, polyolefins, or polyvinylidene-chlorides. They shall be formed into a stable network of filaments or yarns retaining dimensional stability relative to each other. The geo-textile shall be free of defects and conform to the physical requirements in Tables 1 and 2. The geotextile shall be free of any chemical treatment or coating that significantly reduces its porosity. Fibers shall contain stabilizers and/or inhibitors to enhance resistance to ultraviolet light.

Thread used for factory or field sewing shall be of contrasting color to the fabric and made of high strength polypropylene, polyester, or polyamide thread. Thread shall be as resistant to ultraviolet light as the geotextile being sewn.

Geotextiles shall be classified based on the method used to place the threads or yarns forming the fabric. The geotextiles will be grouped into woven and nonwoven types.

**Woven** – Fabrics formed by the uniform and regular interweaving of the threads or yarns in two directions. Woven fabrics shall be manufactured from monofilament yarn formed into a uniform pattern with distinct and measurable openings, retaining their position relative to each other. The edges of fabric shall be selvaged or otherwise finished to prevent the outer yarn from unraveling.

**Nonwoven** – Fabrics formed by a random placement of threads in a mat and bonded by heat-bonding, resin-bonding, or needle punching. Nonwoven fabrics shall be manufactured from individual fibers formed into a random pattern with distinct, but variable small openings, retaining their position relative to each other when bonded by needle punching, heat, or resin bonding. The use of nonwovens other than the needle punched geotextiles is somewhat restricted (see note 3 of Table 2).

The Type and Class of geotextile shall be as shown on the drawings.

**Table 1 Requirements for woven geotextiles**

Property	Test Method	Class I	Class II & III	Class IV
Tensile strength (pounds) <u>1/</u>	ASTMD4632 grab test	200 minimum in any principal direction	120 minimum in any principal direction	180 minimum in any principal direction
Elongation at failure (percent) <u>1/</u>	ASTMD4632 grab test	<50	<50	<50
Puncture (pounds) <u>1/</u>	ASTMD4833	90 minimum	60 minimum	60 minimum
Ultraviolet light (% residual tensile strength)	ASTMD4355 150-hr exposure	70 minimum	70 minimum	70 minimum
Apparent opening size (AOS)	ASTMD4751	As specified, but no smaller than 0.212 mm(#70) <u>2/</u>	As specified, but no smaller than 0.212 mm(#70) <u>2/</u>	As specified, but no smaller than 0.212 mm(#70) <u>2/</u>
Percent open area (percent)	CWO-02215-86	4.0 minimum	4.0 minimum	1.0 minimum
Permittivity sec <u>-1/</u>	ASTMD4491	0.10 minimum	0.10 minimum	0.10 minimum

1/ Minimum average roll value (weakest principal direction).

2/ U.S. standard sieve size

Note: CWO is a USACE reference

**Table 2 Requirements for nonwoven geotextiles**

Property	Test Method	Class I	Class II	Class III	Class IV <u>3/</u>
Tensile strength (lb) <u>1/</u>	ASTMD 4632 grab test	180 minimum	120 minimum	90 minimum	115 minimum
Elongation at failure (%) <u>1/</u>	ASTMD 4632	≥50	≥50	≥50	≥50
Puncture (pounds)	ASTMD 4833	80 minimum	60 minimum	40 minimum	40 minimum
Ultraviolet light (% residual tensile strength)	ASTMD 4355 150-hr exposure	70 minimum	70 minimum	70 minimum	70 minimum
Apparent opening size (AOS)	ASTMD4751	As specified max. #40 <u>2/</u>	As specified max. #40 <u>2/</u>	As specified max. #40 <u>2/</u>	As specified max. #40 <u>2/</u>
Permittivity sec <u>-1/</u>	ASTMD4491	0.70 minimum	0.70 minimum	0.70 minimum	0.10 minimum

1/ Minimum average roll value (weakest principal direction).

2/ U.S. standard sieve size.

3/ Heat-bonded or resin-bonded geotextile may be used for classes III and IV. They are particularly well suited to class IV. Needle-punched geotextiles are required for all other classes.

### 3. Storage

Before use, the geotextile shall be stored in a clean, dry location out of direct sunlight, not subject to extremes of either hot or cold temperatures, and with the manufacturer's protective cover undisturbed. Receiving, storage, and handling at the job site shall be in accordance with the requirements listed in ASTM D 4873.

### 4. Surface preparation

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. It shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions, and standing or flowing water (unless otherwise specified in drawings).

### 5. Placement

Before the geotextile is placed, the soil surface will be reviewed for quality assurance of the design and construction. The geotextile shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings. It shall be unrolled along the placement area and loosely laid, without stretching, in such a manner that it conforms to the surface irregularities when material or gabions are placed on or against it. The geotextile may be folded and overlapped to permit proper placement in designated area(s).

**Method 1** – The geotextile shall be joined by machine sewing using thread material meeting the chemical requirements for the geotextile fibers or yarn. The sewn overlap shall be 6 inches, and the sewing shall consist of two parallel stitched rows at a spacing of about 1 inch and shall not cross (except for any required re-stitching). The stitching shall be a lock-type stitch. Each row of stitching shall be located a minimum of 2 inches from the geotextile edge. The seam type and sewing machine to be used shall produce a seam strength, in the specified geotextile, that provides a minimum of 90 percent of the tensile strength in the weakest principal direction of the geotextile being used, when tested in accordance with ASTM D 4884. The seams may be factory or field sewn.

The geotextile shall be temporarily secured during placement of overlying material to prevent slippage, folding, wrinkling, or other displacement of the geotextile. Unless otherwise specified, methods of securing shall not cause punctures, tears, or other openings to be formed in the geotextile.

**Method 2** – The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified) and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a **U**, **L**, or **T** shape or contain "ears" to prevent total penetration through the geotextile. Steel washers shall be provided on all but the **U**-shaped pins. The upstream or upslope geotextile shall overlap the abutting downslope geotextile. At vertical laps, securing pins shall be inserted through the bottom layers along a line through approximately the mid-point of the overlap. At horizontal laps and across slope labs, securing shall be inserted through the bottom layer only. Securing pins shall be placed along a line about 2 inches in from the edge of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate to prevent any undue

slippage or movement of the geotextile. The use of securing pins will be held to the minimum necessary. Pins are to remain in place unless otherwise specified.

Should the geotextile be torn or punctured, or the overlaps or sewn joint disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or grade distortion, the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of geotextile being used and overlaying the existing geotextile. When the geotextile seams are required to be sewn, the overlay patch shall extend a minimum of 1 foot beyond the edge of any damaged area and joined by sewing as required for the original geotextile except that the sewing shall be a minimum of 6 inches from the edge of the damaged geotextile. Geotextile panels joined by overlap shall have the patch extend a minimum of 2 feet from the edge of any damaged area.

Geotextile shall be placed in accordance with the following applicable specification according to the use indicated in drawings:

***Slope protection*** – Class I or II as indicated in Tables 1 and 2.

The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. Rock shall not be pushed or rolled over the geotextile.

Class I, unprotected – limit height for dropping stone onto bare geotextile to 3 feet.

Class II, protected – require the use of 6 inches a clean pit-run gravel over the geotextile to cushion the stone and limit the height of drop to 3 feet.

On slopes with strong seepage flow, the geotextile must be in intimate contact with the soil to prevent erosion of the soil surface. Use 6 inches of a clean pit-run gravel over the geotextile to hold it in place and minimize voids under the riprap. Embedment of the geotextile in a trench to form a cutoff at regular intervals down the slope will prevent erosion under the fabric. Place cutoffs more closely together in highly erodible soils and wider apart in more stable soils.

***Subsurface drains*** – Class III as indicated in Tables 1 and 2.

The geotextile shall not be placed until drainfill or other material can be used to provide cover within the same working day. Drainfill material shall be placed in a manner that prevents damage to the geotextile. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet.

***Road stabilization*** – Class IV as indicated in Tables 1 and 2.

The geotextile shall be unrolled in a direction parallel to the roadway centerline in a loose manner permitting conformation to the surface irregularities when the roadway fill material is placed on its surface. In no case shall material be dropped on uncovered geotextile from a height of more than 5 feet. Unless otherwise specified, the minimum overlap of geotextile panels joined without sewing shall be 24 inches. The geotextile may be temporarily secured with pins recommended or provided by the manufacturer, but they shall be removed before the permanent covering material is placed.

## **6. Measurement and payment**

**Method 1** – For items of work for which specific unit prices are established in the contract, the quantity of geotextile for each type placed within the specified limits is determined to the nearest specified unit by measurements of the covered surfaces only, disregarding that required for anchorage, seams, and overlaps. Payment is made at the contract unit price. Such payment constitutes full compensation for the completion of the work.

**Method 2** – For items of work for which specific lump sum prices are established in the contract, the quantity of geotextile is not measured for payment. Payment for geotextiles is made at the contract lump sum price and constitutes full compensation for the completion of the work.

**All methods-** The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 7 of this specification.

## **7. Items of work and construction details**

Items of work to be performed in conformance with this specification and the construction details therefore are:

### **Bid Item \_\_\_\_, Geotextile**

- 1) This item consists of furnishing and installing geotextile fabric as shown on the drawings.
- 2) In Section 6, Measurement and Payment, Method \_\_\_\_ will be used.